Hospital Topics

Plasticised polyvinylchloride as a temporary dressing for burns

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Abstract

Plasticised polyvinylchloride film has been used in this burns unit for a long time for dressings before the ward round, before surgery, and when the burned patient is transferred from the casualty department to the burns unit. Plasticised polyvinylchloride film is easy to use, safe, and causes no pain. Most importantly, in the present financial climate, it is cheap.

Introduction

Plasticised polyvinylchloride is a thin (<25 μm), clear, plastic sheeting that was originally produced for wrapping foodstuffs (as Clingfilm, Wrapfilm, etc). It has been in constant use for 30 years in the United States and for 25 years in the United Kingdom. It has been used as a dressing for burns, but unsuccessfully,[1,2] and as a temporary dressing for wounds. We have been using it for the past three years in the Nottingham region as a temporary burns dressing.

Polyvinylchloride is a brittle plastic, so plasticisers, including diethylhexyladipate, are added to make it pliable (see table I). It has some peculiar characteristics: it is clear, it is waterproof, and it has a low coefficient of friction. It adheres to itself but not to a wound or intact skin and, being pliable, will easily cover the contours of an irregular wound. It is permeable to oxygen, carbon dioxide, and water vapour, but as it does not adhere to the wound fluid can collect between the film and the wound (when exudate formation is in excess of 800 ml/m²/24 h).

Uses

We have used plasticised polyvinylchloride in three circumstances:

For the ward round—This burns unit has a policy of dressing all burns except those on the face. When a wound is to be viewed on the doctors' round there may be some delay before it is seen, particularly if there are several dressings for the nurses to take down. A sheet of polyvinylchloride film is wrapped around the wound and sealed to itself.

Before operation—If a burns dressing has been inspected on the morning of surgery or if the dressings are particularly offensive and the patient is to be bathed before the operation the wound is wrapped in polyvinylchloride and left undisturbed until the patient is anaesthetised.

Transfer of burns patients—For the past 12 months the burns of patients who have been transferred from the region's casualty departments have been dressed with plasticised polyvinylchloride. Previously patients have arrived with a variety of dressings, including wet soaks (which may cool a small child too much), dry dressings (which adhere to the burn and are difficult to remove), petroleum jelly gauze dressings (which are ideal but are time consuming to apply and remove and are thus expensive), and occasionally silver sulphadiazine (Flamazine) (which makes the wound look white because of the cream base and makes it difficult to estimate the depth of the burn). We have had no problems using polyvinylchloride film for acute burns on patients who have been transferred, and the casualty departments have been enthusiastic concerning the ease of application and the reduction in nursing time.

During the period 1 November 1985 to 31 October 1986 our burns unit treated 509 patients (359 inpatients and 150 outpatients). The distribution of these patients is typical for admissions to a burns unit, showing almost equal numbers of children and adults and a greater proportion of men: inpatients—123 men, 67 women, and 169 children under 12 years; outpatients—41 men, 21 women, and 88 children under 12. The 150 outpatients had a total of 371 dressing changes during which plasticised polyvinylchloride was used, and of these, 330 were for wounds waiting to be seen on the doctors' ward round. Of the 359 inpatients, 139 attended the outpatient clinic for further dressings after discharge, and polyvinylchloride film was used on 308 occasions (274 for the ward round). Although no accurate record was kept on the number of dressing changes for inpatients, polyvinylchloride film is temporarily applied on average four times to each patient while on the ward, a total of roughly 1400 applications a year.

Advantages

Cost—Plasticised polyvinylchloride is cheap. We purchase it in 12 in and 15 in rolls of "catering quality." Each roll holds 1000 ft, and three 12 in rolls cost £9·81+value added tax and three 15 in rolls £12·42+value added tax. The reusable dispensers are £4·73+value added tax each. Our burns unit has an annual turnover of inpatients of over 300 and dispenses 1500 to 2000 outpatient dressings. We use roughly eight rolls a year.

Easy to apply—The dispensers are kept in the clean utility room, are transferred to a dressing trolley, and then sheets are simply removed from the perforated roll. The nurse touches only the edges of the film, which will not come in direct contact with the wound, and keeps a certain amount of tension on the sheet to stop it crumpling excessively. The wound is then covered with a generous margin of film, and the film adheres to itself where there is overlap. Although aseptic technique is always important in dealing with burns, the ease of application of the polyvinylchloride film makes contamination unlikely.

Patient comfort—Raw wounds and superficial burns are painful when in contact with the air, but when covered by the film they are relatively free of pain. When the patient is transferred from a casualty department blankets and clothing over the film will not adhere and cause pain by rubbing the burn as other dressings may.

Easy, pain free removal—The film is simply removed for wound inspection and causes no pain. We see many infants with large burns, and when the film dressing is removed the infant rarely cries and often seems not to notice the dressing coming off.

Transparency—The film is clear and the wound can be seen well through it. A further advantage in burn wounds is that finger pressure may be applied through the film to see if there is a good capillary return when the depth of a burn is not certain.

Appearance of burn—The diagnosis of the depth of a burn is mostly made on its appearance after 48 hours, although an accurate history of the cause of

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the burn may give a clue. The film does not seem to change the look of a wound, although if it is left on for, say, over an hour the wound may look soggy.

Discussion

Plasticised polyvinylchloride should be used only as a short term dressing. Its use for skin graft donor sites and deep dermal burns has been reported,[2] but it has been suggested that multiplication of micro-organisms in the fluid between the film and tissue may lead to destruction of epithelial cell remnants and conversion of partial thickness to full thickness skin loss.[1] Harrison *et al* and Harris *et al* reported gross bacterial contamination of burned tissues and skin graft donor sites after using films that were thicker than the present film (75-125 μm compared with <25 μm).[3,4]

Several reports in the media recently have concerned the possible carcinogenicity of polyvinylchloride film. The main additive to the polymer is diethylhexyladipate (table I), a lipid soluble compound that has been shown to be absorbed by the fats in foods such as cheese and meat when in prolonged contact.[5] Mice that were given diethylhexyladipate as 1·2% of their diet over two years produced liver tumours.[6] This, however, is probably a phenomenon specific to the species, affecting a hepatocyte peroxide generating enzyme.

TABLE I—*Typical formulation of polyvinylchloride for foodstuffs*

	%
Polyvinylchloride polymer	65-70
Diethylhexyladipate (primary plasticiser)	20-25
Epoxidised soya bean oil (secondary plasticiser)	3-10
Antifogging agent (prevents formation of beads of moisture on film)	1-5
Calcium/zinc stearate (thermal stabiliser)	0·3-1·5
Stearic acid (release agent)	0·2-1·0
Colour improver	<1

At a symposium in 1983 on migration of plasticisers from plastics it was reported that a typical human diet has a maximum intake of 2 g diethylhexyladipate a year (M Rudt, proceedings of the fourth international symposium on migration, Unilever, Hamburg, November, 1983). Tumours in humans have been reported in workers in vinyl chloride and polyvinylchloride factories. There is an appreciable increase in the number of neoplasms in workers with a long exposure (over one year) to vinyl chloride monomer and the polyvinylchloride polymerisation process, and hepatic angiosarcoma and brain tumours have been reported.[7,8] There have also been reports of lytic bone lesions, pneumoconiosis, asthma, and dermatitis.[9-12]

Diethylhexyladipate can also leach out of blood product bags, and long term repeated transfusions and chronic haemodialysis produce high tissue levels of plasticiser with associated liver damage.[13] Such problems occur with very long term exposure, whereas the patient whose burns are dressed with polyvinylchloride film is in contact with the film for a total of a few hours only. If one is concerned about the theoretical carcinogenic properties of the diethylhexyladipate contained in the film, an alternative material is polyethylene film, which is naturally pliable and has no added plasticiser. We have tried polyethylene film on our unit. The properties and cost are similar, but the polyethylene is not as easy to straighten when it becomes crumpled.

Polyvinylchloride film is produced at a high temperature and is immediately rolled so that contamination is unlikely to occur. Microbes do not adhere to the film, and it is difficult to recover organisms from the film. Filip *et al* exposed polyvinylchloride sheets in a wet cooling tower for six to 20 weeks and showed very few bacterial colony counts.[14] There were growths of actinomycetes and fungi. *Pseudomonas aeruginosa* (an important pathogen in the burned patient) was not detected.

Lawrence showed that for burns that are dressed (and not treated by exposure) quantitative bacteriology from tissue biopsy specimens provides little information beyond that obtained by surface swabbing.[15] On our unit all burns are swabbed when the patient is admitted and when each dressing is changed. The organisms that often cause clinical concern in a burns unit are β haemolytic streptococci (Lancefield group A), *Pseudomonas aeruginosa*, multiresistant *Acinetobacter anitratus*, and methicillin resistant *Staphylococcus aureus*. Other Lancefield groups (B, C, and G) of β haemolytic streptococcus occasionally cause loss of skin grafts.

For the period 1 November 1985 to 31 October 1986 we looked at the patients in whom a positive swab for one of the above organisms was clinically important. Sixty seven (23%) of the 289 patients who attended the outpatient clinic (139 had been inpatients) had a swab that was positive (table II). Ten of these cases had attended as an outpatient only. Of the 359 inpatients, only 59 (16%) were in this category. One patient grew methicillin resistant *Staphylococcus aureus*, but this did not affect the clinical course. Two patients had pseudomonas septicaemia that was confirmed by blood culture, and one of these died.

TABLE II—*Positive bacteriological swabs of clinical importance*

	Inpatients (n=359)	Outpatients (not admitted) (n=150)	Total No of outpatients (n=289)
β Haemolytic streptococci Lancefield group:			
A	31	4	33*
B	12	2	14
C	0	1	1
G	6	2	8
Acinetobacter anitratus (multiresistant)	10 (2)	1 (0)	11 (2)

*Two patients with *Streptococcus* A did not require follow up.

We cannot compare these figures directly with those from other units, such as Birmingham and Billericay, as there are too many variants such as the size of burn, methods of bacterial isolation, and types of dressing.[15] Also, there are no figures available from our unit before polyvinylchloride film was routinely used. Our infection rates appear to be low, however, and we are satisfied that there has been no appreciable increase in infection since its introduction.

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